DESIGN OF BLUETOOTH CONTROLLER FOR SOLAR GRASS TRIMMER

SITI RAUDHAH BINTI RADUAN

BACHELOR OF ENGINEERING TECHNOLOGY
(ELECTRICAL)
UNIVERSITI MALAYSIA PAHANG

DESIGN OF BLUETOOTH CONTROLLER FOR SOLAR GRASS TRIMMER

SITI RAUDHAH BINTI RADUAN

Thesis submitted in fulfilment of the requirements
for the award of the degree of
Bachelor of Engineering Technology in Electrical

Faculty of Engineering Technology
UNIVERSITI MALAYSIA PAHANG

JANUARY 2019

STATEMENT OF AWARD FOR DEGREE

1. Bachelor of Engineering Technology

Thesis submitted infulfilmentof the requirements for the award of Bachelor of Engineering Technology (Electrical) with Hons.

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of degree of Bachelor of Engineering Technology (Electrical) with Hons.

Signature:

Name of Supervisor: DR.NADZIRAH BTE MOHD MOKHTAR.

Position: SENIOR LECTURER, FACULTY OF ENGINEERING TECHNOLOGY, UNIVERSITI MALAYSIA PAHANG.

Date: JANUARY 2019.

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries in which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature:
Name: SITI RAUDHAH BINTI RADUAN.
ID Number: TB15018.
Date: JANUARY 2019.

ACKNOWLEDGEMENTS

I am sincerely grateful to ALLAH “S.W.T” for giving me wisdom, strength, patience and assistance to complete my project work. Had it not been due to His will and favour, the completion of this study would not have been achievable.

This dissertation would not have been possible without the guidance and the help of several individuals who contributed and extended their valuable assistance in the preparation and the completion of this study. I am deeply indebted to my supervisor, Dr Nadzirah Bte Mohd Mokhtar for his patient, guidance, comment, stimulating suggestions and encouragement which helped me in all the time of research, writing of this thesis and assistant throughout my project work. I would also like to express very special thanks to Dr. Amir, Mr. ShahrulNaim, Mr. Wan Hassan, Mr. Azmi and Mr. Azlan for their suggestions and co-operation throughout the study.

I also like to convey thanks to the faculty (FTEK) for providing the laboratory facilities and workshop for this project. My sincere appreciation also extends to all my friends, lecturers, teaching engineers and others who provided assistances and advices, including the crucial input for my planning and workings. The guidance and support received from all was vital for the success of this project.

Especially, I would also like to address my unlimited thanks to my family for their unconditional support, both financially and emotionally throughout my studies. My deepest gratitude goes to my family for their support, patience, love and trust during my study. Finally, I would like to thank everyone who had involved in this study either directly or indirectly.

ABSTRACT

Solar energy is that the heat and light-weight radiations received from the Sun. It is one among the foremost galore types of non-conventional, renewable energy supply found on the world. It is without delay on the market, freed from value and is pollution free. Solar energy is controlled to be become electricity and power by the utilization of devices like star panels that consists of electrical phenomenon cells. Solar system receiving more attention through this year because of its advantages compare to other renewable energy. Solar power is one of the suitable renewable green energy to be used in Malaysia as located in tropical regions and situated near to the equator. Besides, Malaysia is able to receive enough radiation of the light energy from the sunlight to generate electricity. The demand and request for green energy technology produced by renewable energy sources has increased. The objective of this project is to control all the movement and the direction of the trimmer by using an application in the PlayStore. Therefore, the application needs to connect with a Bluetooth device that connected with all the electrical components in the electrical box. So, it will be come up with the trimmer that is transportable, durable, easy to operate and maintain. The advantage of powering a grass trimmer by solar instead of by fuel is principally ecological. It additionally aims to style an Android-hopped-up trimmer of electrical source which a conductor electric grass lawn tool. The heart of the machine may be a battery hopped-up DC motor. It is additionally helpful technique for our grass trimmer. The present technology usually used for trimming the grass is by exploitation the manually handle device. The Bluetooth-driven the machine for trimming the grass is applied. The device consists of blade that is operated with the assistance of the motor. The battery will then be charge by the solar. Meanwhile, the solar grass trimmer can be operated anywhere within the Bluetooth signal range by the mobile phone of the owner.

ABSTRAK

Tenaga solar ialah radiasi panas dan cahaya yang diterima dari Matahari. Ia adalah salah satu daripada pelbagai jenis bekalan tenaga yang tidak boleh diperbaharui secara konvensional di dunia. Tenaga solar adalah sejenis sumber yang tiada dijumpai di pasaran, malah ia dikeluarkan dalam sebuah nilai dan bebas dari pencemaran. Tenaga solar dikawal untuk menjadi tenaga elektrik dan kuasa oleh penggunaan peranti seperti panel bintang yang terdiri daripada sel-sel fenomena elektrik. Sistem solar mendapat lebih banyak perhatian sepanjang tahun ini kerana kelebihannya berbanding dengan tenaga boleh diperbaharui yang lain. Kuasa solar adalah salah satu tenaga hijau yang boleh diperbaharui yang akan digunakan di Malaysia yang terletak di kawasan tropika dan terletak berhampiran dengan Khatulistiwa. Selain itu, Malaysia mampu menerima sinaran matahari yang cukup untuk menghasilkan tenaga elektrik. Permintaan untuk teknologi tenaga hijau yang dihasilkan oleh sumber tenaga boleh diperbaharui telah meningkat. Objektif projek ini adalah untuk mengawal semua pergerakan dan arah mesin dengan menggunakan aplikasi di PlayStore. Oleh itu, aplikasi ini perlu membuat sambungan dengan peranti Bluetooth bagi memastikan mesin berjalan dengan lancar. Oleh itu, ia akan menghasilkan mesin rumput yang mudah dibawa kemana-mana, tahan lama, mudah dikendalikan dan juga diselenggara. Kelebihan untuk memelihara mesin rumput yang terdiri daripada tenaga solar adalah lebih ekologi. Ia juga bertujuan untuk gaya kebergantungan mesin rumput Android ini yang terdiri daripada sumber elektrik konduktor. Nadi utama mesin daripada motor DC akan disambung terus dengan bateri. Ia juga merupakan teknik tambahan untuk mesin rumput kami. Teknologi sekarang yang biasa digunakan untuk memangkas rumput adalah dengan mengeksploitasi peranti pengendalian secara manual. Oleh itu, Bluetooth digunakan untuk memotong rumput sekaligus menggerakkan mesin. Peranti ini terdiri daripada bilah yang digerakkan dengan bantuan motor. Bateri akan dicas semula oleh solar. Sementara itu, mesin rumput solar ini boleh dikendalikan di mana-mana sahaja asalkan masih di dalam jarak isyarat yang ditetapkan bagi Bluetooth dengan telefon bimbit pemilik.

TABLE OF CONTENTS

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

Ah	Ampere hour
A	Ampere
cm	Centi meter
E	Back electromotive force
e^-	Electron
g	Gram
HP	Horse power
I	Current
kW	Kilowatt
kHz	Kilo Hertz
m	Meter
P	Power
R	Resistance
V	Volt
°C	Degree Celsius
Ω	Ohm
η	Efficiency
ω	Speed

LIST OF ABBREVIATION

AC	Alternating Current
AGM	Absorbent Glass Mat
ARM	Advanced RISC Machines
AVR	Advanced Virtual RISC
CC	Constant Current
CdTe	Cadmium Telluride
CIGS	Copper Indium Gallium Selenide
CV	Constant Voltage
DC	Direct Current
DIR	Direction control
EMF	Electro Motive Forces
FF	Fill Factor
GND	Ground
IC	Integrated Circuit
I_{SC}	Current Short Circuit
MD30C	Motor Driver 30 Current
PIC	Peripheral Interface Controller
PWM	Pulse Width Modulation
RPM	Revolutions Per Minute
Rx	Receiver pin
SLA	Sealed Lead-Acid
SOC	State Of Charge
TCO	Transparent Conductive Oxide
Tx	Transmitter pin
Vcc	Voltage input

Vin	Voltage input
Voc	Voltage Open Circuit

CHAPTER 1

INTRODUCTION

1.1 Project Background

In the time where technology is merging with environmental awareness, consumers are looking for ways to contribute to the environment by using devices with eco-friendly technology to decrease the pollution and protect the nature. Pollution is manmade and can be seen in our own daily lives, more specifically in our own homes. Mostly, gas powered lawn mower are one of devices that contribute to the pollution especially air pollution. If using electrical powered, for sure it consumes large amount of energy for the working to move the cutting blades and the wheels. Nowadays, all the creation and new devices going under automation so our team tried to reduce the human effort for the trimming job.

The design objective is to come up with a grass trimmer that is portable, durable, easy to operate and maintain. It also aims to design a self-powered trimmer of electrical source which is a cordless electric grass trimmer. The heart of the machine is a battery-powered DC electric motor. The use of cable ties as blade makes the design unique such that less energy is needed for the motor to spin the blade. Thus, the machine is considered highly efficient as it uses no human effort and is readily adaptable for cutting conditions.

The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor. We also use a solar panel to charge the battery so that there is no need of charging it externally. The grass trimmer and vehicle motors are interfaced to a microcontroller that controls the working of all the motors. The microcontroller moves the vehicle motors in forward direction in case if the owner give an instruction in forward. Meanwhile, the microcontroller stops the grass trimmer motor if the owner gives the instruction to do so. Thus this system allows a Bluetooth controlled grass trimming system with only one human needed.

1.2 Problem Statement

Nowadays, most of the activities which included human efforts are either replaced or automated by the use of machines or other kinds of equipment. The present technology commonly used for cutting the grass is by using the manually handle device which inconvenience due to heavy machines to carry and required human effort for proper handle. Bluetooth solar grass trimmer is one of the machines for a public appliance to reduce human effort for trimming job.

In the time where technology is merging with environmental awareness, consumers are looking for ways to contribute for reducing the cause of pollution. By switching to modern technology from traditionally aspect, the implementation of solar trimmer devices is more environmental friendly compared to old cutting devices which can contributes to air pollution due to the internal combustion of engine. Therefore, solar grass trimmer devices are more preferable where the energy can be supplied from sunlight that absorbed by the solar panel to generate electricity.

Besides, the traditional lawn mower will consume engine oil in their fuel combustion to generate energy which generally creates byproducts and harmful pollutants. Thus, the energy efficiency can be achieved with the help of motor by using the solar energy. The grass trimmer device is solar powered which the battery can be charge manually from main supply. Hence, the energy consumption can be reduced and carbon emission can be minimized.

In response to this problem, the project purpose is to improve design on several options for traditional grass cutter devices into Bluetooth solar grass trimmer devices that can increase the energy efficiency and reduce pollution. The usage of solar panel and the microcontroller (Arduino) as well as Bluetooth device as the main controller will provide some change in energy consume by solar grass trimmer.

Bluetooth Solar Grass Trimmer is chosen for our project because of the nowadays technology which commonly using the manually handle device for trimming the grass. The trimmers sold on market in this day needs manual handle from the users. Our team decided to upgrade those manually handle grass trimmer to the Bluetooth solar grass trimmer which use solar energy.

This proposal was written to put into words about our project entitled Bluetooth Solar Grass Trimmer. This machine is a controlled grass trimmer which used to trim the

grass such as cow grass at the house compound or other suitable places by using a Bluetooth device. The device consists of cable ties which are operated with the help of the motor and the power supply for the motor is from the battery. The battery can be charge by using the solar panel with the help of solar charge controller.

This project may explore the new investigation field as a team to build this Bluetooth solar grass trimmer as our Senior Design Project. At the end of the project, we expected to build a portable size of Bluetooth solar grass trimmer with its solar charger. Our aim is to fabricate a grass trimming machine system which runs with the help of motor by using the solar energy.

1.3 Research Objectives

The objectives of the project are as follows:

- To fabricate a Bluetooth solar grass trimmer that easy to handle.
- To program a Bluetooth solar grass trimmer which can driven by the motor driver and be able to communicate with the Bluetooth HC-05.
- To power the Bluetooth solar grass trimmer with the solar panel system.

1.4 Scopes Of Study

This project is proposed to improve the controller by designing the Bluetooth module in the electrical circuit. In order to achieve the objectives, the following scopes of works are proposed.

i. Select the best controller in terms of its power rating, cost and efficiency.
ii. Identify the best controller supporting equipment's such as battery, motor driver, motor, inverter based on the price, size, efficiency and safety.
iii. Design the controller circuit for the solar grass trimmer using the selected Arduino Uno R3, 12VDC motor, MD30C motor driver, DC to AC inverter and HC-05 Bluetooth module.

REFERENCES

Abdulgafar, S.A., et al. (2014). “Improving the Efficiency of Polycrystalline Solar Panel via Water Immersion Method.” International Journal Innovative Research in Science, Engineering and Technology 3:83-89.

Musthafa, M. M. (2015). “Enhancing Photoelectric Conversion Efficiency of Solar Panel by Water Cooling”. Journal of Fundamentals of Renewable Energy and Applications 2015.

Armstrong, S., Glavin, M. E., & Hurley, W. G. (2008). Comparison of Battery Charging Algorithms for Stand Alone Photovoltaic Systems, (February 2014). https://doi.org/10.1109/PESC.2008.4592143

Babatunde, O. A., Shitta, M. B., & Adegbenro, O. (2014). Performance Simulation Of Photovoltaic System Battery, *4*(9), 146–153.

Chowdhury, S., Chowdhury, S. P., Taylor, G. A., & Song, Y. H. (2008). Mathematical modelling and performance evaluation of a stand-alone polycrystalline PV plant with MPPT facility. *IEEE Power and Energy Society 2008 General Meeting: Conversion and Delivery of Electrical Energy in the 21st Century, PES*, (August).

Dunlop, J. P. (n.d.). Batteries and Charge Control in Stand-Alone Photovoltaic Systems Batteries and Charge Control in Stand-Alone Photovoltaic Systems Fundamentals and Application.

Gabler, H., & Sauer, D. U. (1995). A Systematic Effort to Define Evaluation and Performance Parameters and Criteria for Lead-acid Batteries in PV Systems A Systematic Effort to Define Evaluation and Performance Pa- rameters and Criteria for Lead-acid Batteries in PV Systems w ., (October).

ITACA. (n.d.). A Guide To Lead-Acid Batteries, (Iv). Retrieved from http://www.itacanet.org/eng/elec/battery/battery.pdf

Lokeshreddy, M., Kumar, P. J. R. P., Chandra, S. A. M., Babu, T. S., & Rajasekar, N. (2017). Comparative study on charge controller techniques for solar PV system. *Energy Procedia*, *117*, 1070–1077.

Manual, U., Functions, R. B., & Mode, N. (n.d.). PV Charge Controller.

marufa, F. (n.d.). Designing Charge Controller for the Solar Battery Charging Station (Sbcs), 1–55.

Murnane, M. (n.d.). A Closer Look at State of Charge (SOC) and State of Health (SOH) Estimation Techniques for Batteries.

Output, P. P., & Curves, I. (n.d.). Understanding Solar Energy, 1–19.

Perez, R. (1993). Lead-Acid Battery State of Charge vs. Voltage, (September), 66–70.

Schwede, J. W., Bargatin, I., Riley, D. C., Hardin, B. E., Rosenthal, S. J., Sun, Y., … Melosh, N. A. (2010). Photon-enhanced thermionic emission for solar concentrator systems. *Nature Materials*, *9*(9), 762–767.

Singh, P., Sujil, A., & Kumar, P. (2016). Analysis and comparison of batteries charging time for stand alone photovoltaic system. *2016 IEEE 6th International Conference on Power Systems, ICPS 2016*, (August).